WHAT IS CLAIMED IS:

1. A method of enhanced purification of a high-purity metal which comprises purifying a metal feed by distillation in a vacuum atmosphere to yield the desired metal with high purity, said method further comprising carrying out a first thermal purification step in which said metal feed in a feed crucible positioned in an upper interior of an inner tube maintaining said vacuum atmosphere is heated and the generated vapor of said desired metal is bought into contact with an inner surface of said inner tube so that the vapor of said desired metal is condensed and recovered in a separate form from impurity elements that have a lower vapor pressure than said desired metal and which are allowed to stay within said feed crucible, and carrying out a second thermal purification step in which said desired metal as recovered is admitted into and heated in a liquid reservoir in a lower part of a tubular member positioned in a lower interior of said inner tube and the generated vapor is passed through a diffuser positioned in an upper part of said tubular member and guided by suction so that the vapor of impurity elements having a higher vapor pressure than said desired metal are solidified in a separate form in a cooling trap positioned below said tubular member and the vapor of said desired metal is brought into contact with said diffuser so that the vapor of said desired metal is condensed and returned to said liquid reservoir, said method being carried out in a purifying apparatus comprising a rigid shell outer tube that accommodates said inner tube, said outer tube having an inner wall which is entirely covered with a carbonaceous heat-insulating material and having an upper heater and a lower heater, each of said upper heater and said lower heater being made of a carbonaceous material, said inner tube, said crucible, said diffuser and any other members placed in said inner tube are also made of a carbonaceous material.

2. The method according to claim 1, wherein said rigid shell is made of a stainless steel having included therein a water jacket.

3. The method according to claim 1 or claim 2, wherein said liquid reservoir is a recovery mold for casting said desired metal having a high purity after enhanced purification.

4. The method according to claim 1 or claim 2, wherein said desired metal is indium, said metal feed is heated at 1100 to 1300°C in the first thermal purification step and said desired metal as recovered is heated at 900 to 1200°C in the second thermal purification step.

5. The method according to claim 3, wherein said desired metal is indium, said metal feed is heated at 1100 to 1300°C in the first thermal purification step and said desired metal as recovered is heated at 900 to 1200°C in the second thermal purification step.

6. The method according to claim 4, wherein said desired metal is indium, said metal feed is heated at 1100 to 1300°C in the first thermal purification step and said desired metal as recovered is heated at 900 to 1000°C in the second thermal purification step.

7. The method according to claim 5, wherein said desired metal is indium, said metal feed is heated at 1100 to 1300°C in the first thermal purification step and said desired metal as recovered is heated at 900 to 1200°C in the second thermal purification step.

8. The method according to claim 1 or claim 2, wherein said desired metal is at least one metal selected from the group consisting of antimony, zinc, tellurium, magnesium, cadmium, bismuth and silver.

9. The method according to claim 3, wherein said desired metal is at least one metal selected from the group consisting of antimony, zinc, tellurium, magnesium, cadmium, bismuth and silver.

10. The method according to claim 1, wherein the carbonaceous heat-insulating material is graphite or carbon fiber, and the carbonaceous material is graphite.

11. An apparatus for enhanced purification of a high-purity metal, which comprises an inner tube in which a vacuum atmosphere is to be formed, a first heating chamber provided in an upper interior of said inner tube, a second heating

chamber provided in a lower interior of said inner tube, said first heating chamber accommodating a feed crucible with an open top into which a metal feed is charged and the desired metal in said metal feed is evaporated for recovery while impurity elements having a lower vapor pressure than said desired metal are separated by being allowed to stay within said feed crucible, said second heating chamber accommodating a tubular member having in a top thereof an inlet for receiving said desired metal as recovered and an outlet through which impurity elements that have a higher vapor pressure than said desired metal and which are evaporated in separate form upon heating are discharged, as well as a liquid reservoir for heating said desired metal which is formed in a lower part of said tubular member, and a diffuser for condensing said desired metal as evaporated which is installed across an upper part of said tubular member, said purifying apparatus comprising a rigid shell outer tube of a larger diameter than said inner tube, said rigid steel outer tube being placed surrounding said inner tube that permits said vacuum atmosphere to communicate with said inner tube and which is substantially concentric therewith, said outer tube having an inner wall which is entirely covered with a carbonaceous heat-insulating material and having an upper heater and a lower heater, each of said upper heater and said lower heater being made of a carbonaceous material, said inner tube, said crucible, said diffuser and any other members placed in said inner tube are also made of a carbonaceous material.

12. The apparatus according to claim 11, wherein said diffuser comprises a plurality of substantially parallel plates each having a plurality of holes made therethrough.

13. The apparatus according to claim 11 or claim 12, wherein at least the inner surface of the ceiling of said inner tube is domed or has a conical shape.

14. The apparatus according to claim 11 or claim 12, wherein said desired metal is at lest one metal selected from the group consisting of antimony, zinc, tellurium, magnesium, cadmium, bismuth and silver.

15. The apparatus according to claim 11, wherein the carbonaceous heat-insulating material is graphite or carbon fiber, and the carbonaceous material is graphite.